

## High Power Station Available and Reliability

Protection and control as a unified system for hydroelectric power plants of Energie AG Oberösterreich

### ■ The company

Energie AG Oberösterreich is the leading infrastructural company in the Upper Austria economic region. The company's core business is generating electric power at market prices in an environmentally sound way. Generating customer satisfaction through appropriate pricing, support and services is the company's foremost commercial objective. In addition to its core business, the company is also active in the business segments of energy services, heat, gas, telecommunications, waste removal and water/sewage.

### ■ The starting situation

The Grossarl power station of Energie AG Oberösterreich was built in 1917. It is located in Salzburg's Grossarl Valley and uses the water of the Grossarler Ache River. Two Francis turbine sets are installed in the powerhouse, which was renovated in 1966. The two synchronous genera-



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tors feed power into the 30 kV busbar system in a unit connection arrangement. From there the power is fed into the power system via two 30 kV line branches. Fig. 1 and Table 1 provide a general view of the substation as well as power station data.

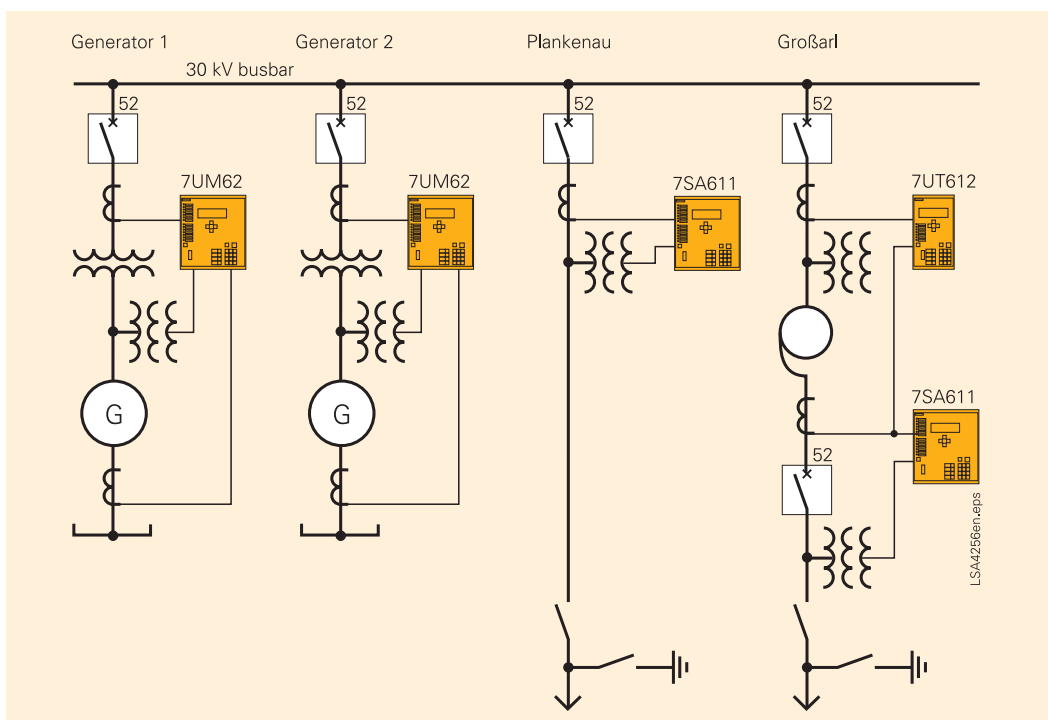


Fig. 1 Power station overview



Fig. 2 Existing switchgear panels with protection relays

The old protection and control design consisted of a multitude of individual components, such as relays, operator control elements, indicators and transducers (Fig. 2) that were interconnected by numerous copper wires and cables.

	Machine 1(2)
Turbine	Francis
Rated power	3.18 MW
Speed	750 RPM
Generator	Three-phase synchronous
Rated power	3.80 MVA
Rated voltage	6.30 kV
Rated current	348 A

Table 1: Power station data

Essential power station components were replaced in 2002. These included electrical and mechanical protection relays, machine automation, control room equipment and the excitation system. This modernization project was designed to include a state-of-the-art protection and control system to meet present and future needs.

■ *The concept*

Electrical safety of power stations requires protection equipment with a high degree of flexibility and functionality. Building on the experience gained with V3 relays, an innovative protection system was created in SIPROTEC 4 that provides entirely new opportunities of integrating protection and automation functions. Communication via PROFIBUS-DP provides a trouble-free link with power station control systems.

*In-depth protection*

Complete power station unit protection is provided by a SIPROTEC 7UM62 multifunction generator, motor and transformer protection relay. Backup protection is provided by a built-in, transformer current-fed overcurrent-time protection relay with capacitor release (Fig. 3).

The existing Bütow transformer continues to be used for stator earth-fault protection, but the control of the load resistors is now provided by the CFC function in the 7UM62. The Bütow transformer generates a displacement voltage even during earth-fault-free operation, so that 100% stator earth-fault protection can be provided without additional equipment.

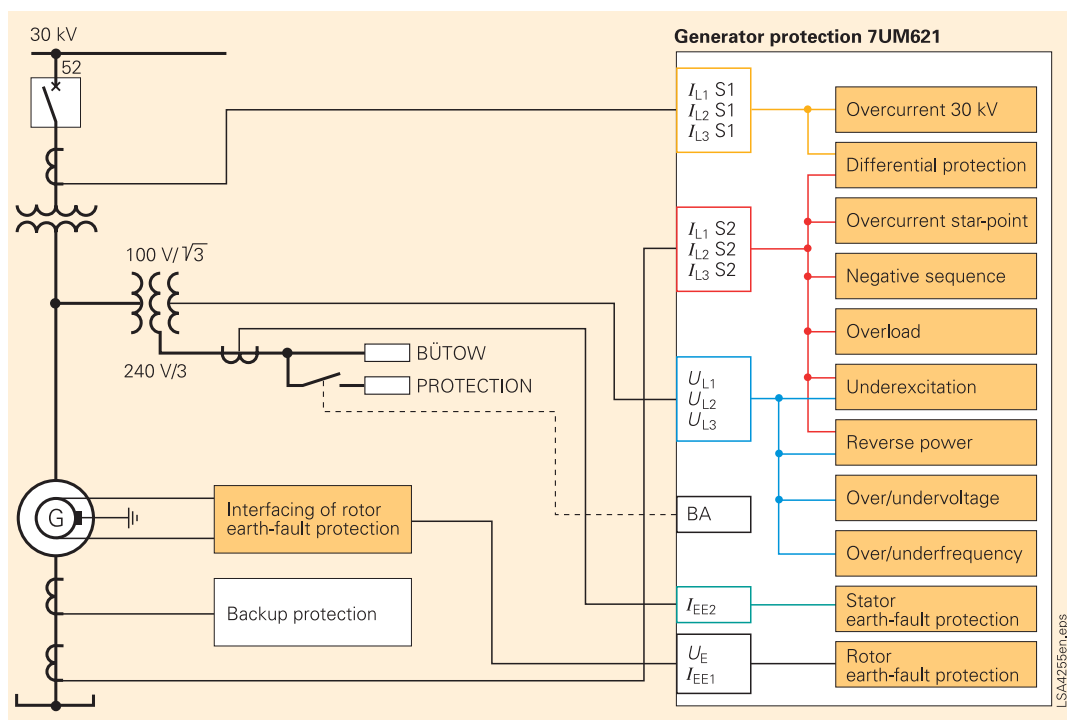


Fig. 3 Concept of generator protection

### Capability of remote operation

The 30 kV lines are protected by a SIPROTEC 7SA611 distance protection relay. All protection relays are connected to a modem via the RS485 service interface (Fig. 4). This linkage provides access to the full range of DIGSI functionality, such as changing parameters, reading operational and fault messages, indication of operational measured values etc. even from a remote location. Remote maintenance and fast fault correction are greatly facilitated as a result.

### A solid foundation: SIMATIC S7

The protection and control system (Fig. 4) is based on SIMATIC S7. Protection and control tasks of the Grossarl power station are divided among three control units that are interconnected via MPI bus. A separate control unit is provided for each machine set and for the general section. One programmable logic controller (PLC) per machine provides the functions of machine automation, mechanical protection and connection of the generator protection via PROFIBUS-DP for transmission of messages and measured values.

Another PLC for the general section controls the 30 kV line feeders, provides connection of the line protection relays via PROFIBUS-DP, and operates the interface to the power station control room (remote control).

### Redundant system

Two touch panels are provided for operation, display of measured values and monitoring (alarm and event lists). Each touch panel can control both machine sets as well as both line feeders. This arrangement provides redundancy in the event of a touch panel failure.

### ■ The special advantages

#### Touch panels provide flexibility

The use of SIMATIC S7 provided a standardized product for the power station protection and control. Operation by touch panels provides greater flexibility to accommodate changes and eliminates the need to install multiple operator control and indicator devices.

#### Simplified engineering and commissioning

The connection of the SIPROTEC 4 protection relays to SIMATIC S7 via PROFIBUS eliminates the need for externally mounted measurement transducers as well as for analog and binary inputs to the PLC. The elimination of these hardware components also reduces the engineering and commissioning effort and cost.

This simplification of the installation and wiring also drastically shortened the conversion phase.

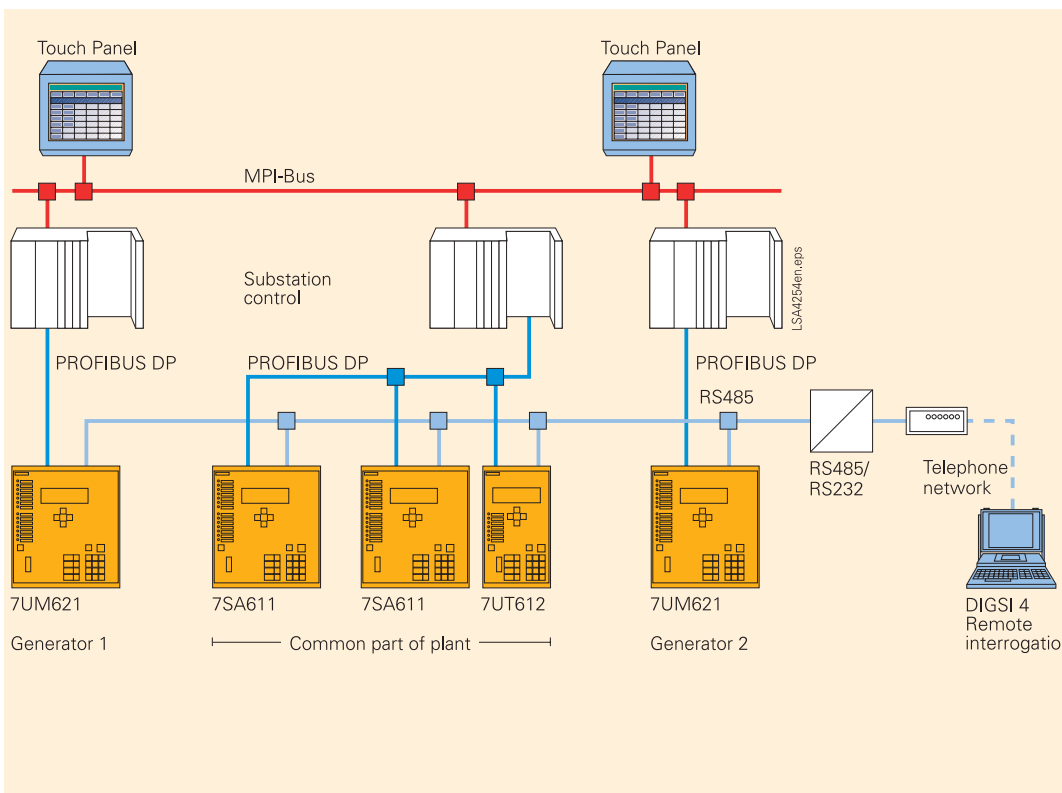


Fig. 4 Interconnection to power plant control system

#### *Uniform equipment operation*

The uniform protection design with SIPROTEC 4 relays is advantageous as it supports uniform operation of the generator and line protection and provides the capability of remote maintenance.

#### *High plant availability*

The extensive self-monitoring of the system components results in substantial improvement in plant availability and reliability.

#### ■ *Conclusion*

A cost-optimized, state-of-the-art protection and control system was implemented during the modernization of individual power station components at the Grossarl power station of Energie AG Oberösterreich.

Of great advantage were not only the trouble-free integration into the power station control system but also SIPROTEC multifunction protection relays' compact design.